DEEP LEARNING TECHNIQUES FOR RECOMMENDATION SYSTEM IN E-COMMERCE MARKET

SHORT SYNOPSIS

Submitted in partial fulfillment of the requirement of the degree of

DOCTOR OF PHILOSOPHY

by

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DECLARATION BY THE SCHOLAR

I hereby declare that the short synopsis entitled "**Deep Learning Techniques for Recommendation System in E-Commerce Market**" being submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in the **Department of Computer Science & Technology** under the **School of Engineering** of Manav Rachna University, Faridabad during the academic year 2023-24.

It is the work that is expected to be carried out under the supervision of **Prof. (Dr.) Goldie Gabrani** and co-supervision of **Dr. Atul Mishra**.

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This is to certify that, the short synopsis entitled "**Deep Learning Techniques for Recommendation System in E-Commerce Market**" to the best of our knowledge is an original piece of work done by research scholar **Geetanjali Tyagi** under the supervision of **Prof. (Dr.) Goldie Gabrani** and co-supervision of **Dr. Atul Mishra** for the degree of Doctor of Philosophy in the **Department of Computer Science & Technology** under the **School of Engineering** of Manav Rachna University, Faridabad during the academic year 2023-24.

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Abstract

The importance of E-commerce has grown significantly due to the wide expansion of global markets and finance. System analysis and design methodologies are required to construct a fully functional, scalable, efficient, reliable, user-friendly, and secure E-commerce recommendation system. With the rapid growth of internet technologies, most firms have changed their ways of doing things entirely. As e-commerce platforms have emerged, users now can shop virtually from anywhere around the globe without leaving their homes. We need recommendation systems to enhance the User Experience (UX) in E-commerce. These systems help users find relevant products quickly and efficiently. This research proposes a Deep Learning (DL) based hybrid recommendation system. This proposed system aims to help users identify the most suitable products according to their needs while minimizing search time and effort. Additionally, the research compares existing deep learning approaches in e-commerce recommendation systems. The research attempts to deliver a description of the results, a hybrid model prototype, and a comparison of different DL models. The research focuses on improving system performance and user experience to provide more accurate and relevant product suggestions for users. It will also point out areas that need more investigation to fill in current gaps and investigate new avenues in this quickly developing subject.

Keywords: Recommendation, Prediction, User Experience, Algorithms, E-commerce

1. Introduction

Recommendation systems act as personalized guides, using data-driven technology to identify user habits and generate tailored recommendations. These technologies improve the shopping experience by not only helping customers find products but also engaging them with relevant recommendations that drive clicks and purchases (**Alamdari et al., 2020).** The recommendation systems can predict and present products that align with individual user needs and interests.

The primary factor for e-commerce marketing's success lies in the implementation of recommendation algorithms (**Roy & Dutta, 2022**) that tailor the user experience inside the e-commerce industry. The implementation of an e-commerce recommendation system has the potential to aid platforms in delivering highly pertinent information to clients at optimal moments, hence augmenting consumer loyalty **(Kim et al., 2021**) and facilitating a more seamless purchasing process. Fig. 1 illustrates an instance of a recommendation system.

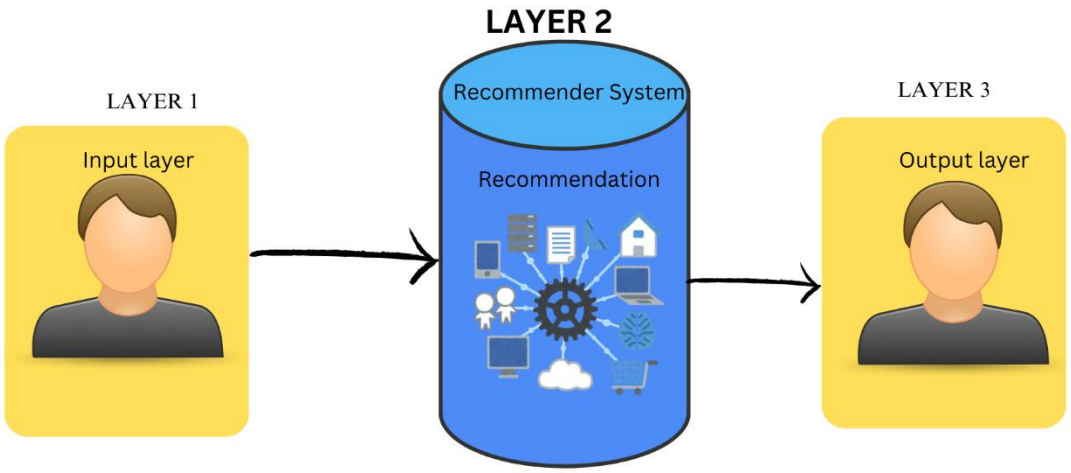

Fig. 1 Instance of a recommendation system

During COVID-19, a notable surge has occurred in the prevalence of online buying. Consequently, this surge has led to a substantial proliferation of data alongside information available online (**Sheikh et al., 2019).** In this Research **(Sethi et al., 2024**) Users face a challenge when selecting a product that matches their preferences, behaviours, and expectations, as some items are hidden. Therefore, it is crucial to create a link or bridge that connects users and products by identifying similarities among users, items, or goods collectively. The multi-directional recommendation system has been beneficial in various

areas, such as economics, learning, social media, and information systems. These systems aim to develop a predictive model that accurately estimates prediction functions.

In the present state of the global e-commerce business, there is a noticeable upward trend in the proliferation of online stores that have implemented sophisticated personalization methods. Previously, tailored suggestion algorithms were only accessible to e-commerce behemoths like Amazon.com, which was among the pioneers in using such systems in its stores. Over the past few years, a substantial rise has occurred in the count of vendors who have begun to create their products or services. As a result, both major and small online retailers now can customize their goods.

Over the past few decades, a variety of models have been applied across a wide range of domains in recommendation systems. Liu et al. (2024) developed the MMSS_MKR model, which leverages a multi-task, multi-channel, and multi-loss approach using the Last.FM music dataset, achieving an accuracy of 76.3%. This model effectively addresses scalability issues in large music datasets. In product recommendation, Yadav et al. (2023) utilized an LSTM model with datasets such as HSWN, ABSA, IIT Bombay, IIT Patna, and Twitter, reaching an 87% accuracy. This model tackles the diversity in product features and user reviews. Asani et al. (2021) introduced a semantic approach for restaurant recommendations using the TripAdvisor dataset, achieving a 92.8% accuracy by managing sequential data for personalized recommendations. Zhou et al. (2020) employed Graph Neural Networks (GNN) for social media recommendations with a Twitter dataset, obtaining an 84.5% accuracy and addressing the complex relationships and interactions prevalent in social media.

1.1. Recommendation Systems in E-Commerce

With the ongoing expansion, online retailers are actively seeking intelligent and efficient strategies to provide customers **(Maphosa & Maphosa, 2023**) with a customized and dynamic purchasing experience that meets their evolving needs and intentions.

The emergence of novel and sophisticated techniques has led to an augmentation in the generation of personalized recommendations for consumers, hence enhancing commercial profitability and expediting the process of acquiring desired products with minimal exertion. Data mining is a method of systematically examining vast quantities of data to extract valuable insights or uncover objects by exploring the connections between other items. Early e-commerce companies such as Amazon and CDNOW have already incorporated recommendation algorithms as a crucial element. Initially, there was a significant demand to

assist individuals in locating suitable products using suggestions and consumer comments. Amazon has created a range of recommendation features since it started, including algorithmic methods like collaborative filtering, as well as non-algorithmic methods like non-personalized recommendations. So, on one side, the utilization of a recommendation system seeks to achieve widespread customisation by offering individual users services that are specifically tailored to their requirements. As part of its operations, Amazon diligently retains the transactions made by its customers.(**Liao & Sundar, 2022)** Personalised suggestions exhibited superior outcomes compared to non-personalized recommendations in terms of click-through rate metrics. Furthermore, personalization is seen as a strategy for cultivating enduring consumer relationships. Recommendation systems remain crucial in the realm of e-commerce and are experiencing ongoing expansion.

Similarity is a fundamental notion employed in the recommendation system. This entails identifying products that are analogous to previous products obtained by the user or that exhibit similarities to one another (proximate neighbour). For instance, on Amazon, users can suggest to the intended user the things that have already been bought by other customers with similar preferences. The resemblance between these individuals and the target user can be determined by analysing all users' evaluations alongside preferences. Hence, it will be feasible to provide suggestions to the intended user for unpurchased products based on their resemblances to other users and the ratings of these items. The recommendation system's performance is dependent on accurate similarity computation in prediction, which employs (**Maphosa & Maphosa, 2023**) collaborative filtering algorithms, binary search, prediction techniques, vectorization models, classification, clustering, and regression algorithms for similarity learning.

1.2. Collaborative Filtering (CF) And Content-Based Recommendation System

Online e-commerce companies use different recommendation engines to suggest recommendations to a variety of users. Filtering based on content, rather than user data, is a technique used for recommending products to users. By analysing user behaviour, their usual activities, ratings, and predicting what they will like based on similarity with other customers, collaborative filtering is based on gathering information. Fig. 2 explains the process of the recommender system

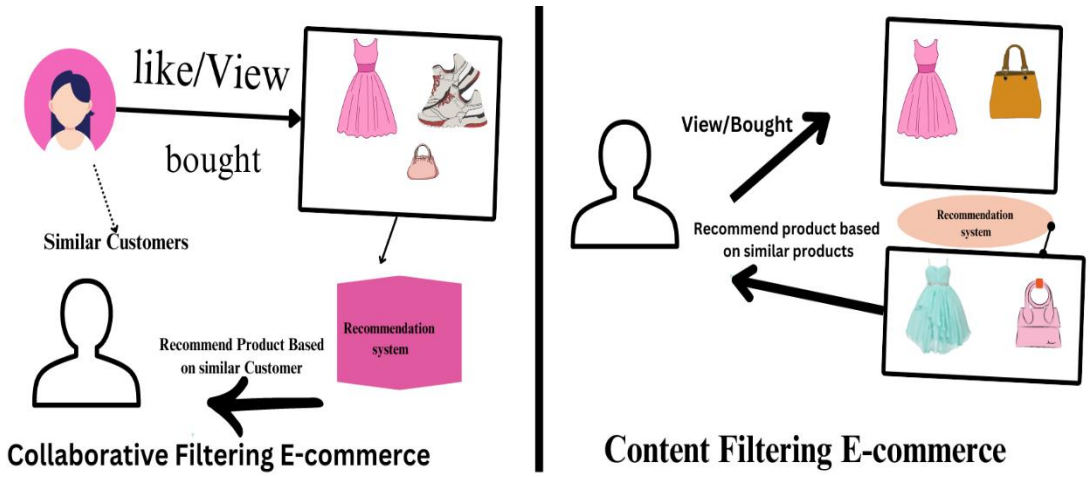

Fig. 2. Recommender System process

1.3. Deep Learning Based Recommendation System

In recent times, deep learning has been utilized in natural language processing, image processing, and recommendation systems to make valuable predictions. With the advancement of technology in various fields, several challenges have emerged in recommendation systems, including accuracy, **(Patro et al., 2023)** sparsity, and the cold-start problem. These challenges are being tackled through various algorithmic approaches, such as **(Wang et al., 2020)** convolutional neural network (CNN), **(Nassar et al., 2020)** recurrent neural network(RNN), **(Ahmadian Yazdi et al., 2024; N & Samraj, 2023)** Long Short-Term Memory Networks(LSTM), Gated recurrent unit (GRU), Deep matrix factorization(DMF) and **(Wang et al., 2020)** Deep neural Network(DNN)-based recommendations.

In Nature, a research report on the use of natural language processing (NLP) techniques to create deep learning models. Most of these studies have shown that deep learning models can accurately detect sentiment in a variety of contexts. Deep neural networks include Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Deep Neural Networks (DNNs), and Recursive Neural Deep Models (RNDs). This type of model can be combined with other models by using hybrid neural networks, such as hierarchical bidirectional RNNs. E-commerce faces challenges when it comes to sentiment analysis due to the presence of fake reviews that may influence customers to buy undesirable products.

1.4. Challenges And Research Gaps

While significant advancements have been made in the field of deep learning recommendation systems for E-commerce, several unresolved issues remain that warrant further investigation.

These gaps highlight areas where current systems fall short and present opportunities for future research:

1. Recent changes in shopping behaviour, especially since the pandemic, have made shopping patterns more complex. (**Javed et al., 2021**)the existing literature does not fully address how recommendation systems can adapt to these evolving patterns and provide accurate suggestions in this new context.
2. With the increase in online shopping, there is a vast amount of information available on the internet. Current systems struggle with efficient processing and filtering this information to make relevant recommendations without overwhelming the user.
3. There is a need for more efficient algorithms that can better handle large-scale data and provide real-time recommendations.
4. There is a lack of comprehensive understanding of how feature selection with distinctive interfaces or functions can enhance user experience and engagement.
5. There is a gap in research on adaptive systems that can continuously learn, and update recommendations based on the latest data and user behaviour.
6. Further research is required to refine DL models to provide more precise and personalized recommendations that align closely with user interests.

2. Literature Review

This section provides an overview of existing studies on E-commerce Recommendation systems and, related work, obstacles and problems encountered in earlier work, the scope of the research with and without deep learning techniques, and some associated publications and systems.

2.1. Insights And Comparative Analysis of Neural Networks

This section outlines how neural networks are applied to e-commerce recommender systems, providing insights into their effectiveness and performance. B. Maleki Shoja and N. Tabrizi highlight the importance of customer reviews for recommendations, addressing challenges of unstructured text data. They use Latent Dirichlet Allocation and deep neural networks for feature extraction, applying Collaborative Filtering for recommendations. Their model outperformed state-of-the-art models, showing significant improvement over Matrix Factorization (MF), Hidden Topics Factors (HTF), and Rating Meet Review (RMR) in most categories. **(He et al. ,(2017)** and **(Mongia et al., 2020)** propose Neural Collaborative Filtering (NCF), which uses multi-layer perceptron to model user-item interactions. This approach captures complex user preferences better than traditional methods and improves recommendation accuracy by integrating various types of information. **(Kaur & Sharma, 2023; Martins et al., 2020)** review deep learning techniques in recommender systems. They find that models like CNNs and RNNs significantly improve user preference predictions. Hybrid models combining neural networks with other methods are particularly effective, albeit resource-intensive.

2.2. Challenges In Filtering Algorithms - Collaborative Filtering (CF) And Content Filtering

In their Research **(Ha & Lee, 2017; Liao & Sundar, 2022),** the authors investigate the varieties of CF algorithms and the challenges they encounter when working with new users or items that are based on historical data in CF. In their paper, they suggest a novel method that is based on a network-based and item-network approach. The proposed model was validated by conducting tests on Last.fm data. In terms of accuracy, recall, and F1 scores, this model outperformed both user-based and item-based collaborative filtering methods.

2.3. Comparative Research of Recommender Models

In this section comparison of various Recommender models. Each Model comparison with

different scenario focusing on their strength and limitations.

Table 1. Different types of Recommendation and related methodologies

Recommendation	Authors	Model Used	Dataset Used	Accuracy
Music Recommendation	(Liu et al., 2024)	multi-task, multi-channel and multi-loss music recommendation knowledge graph model (MMSS_MKR) model	Last.FM Music Dataset	76.3%
Product Recommendation	(Yadav et al., 2023)	LSTM	HSWN, ABSA, IIT Bombay, IIT Patna, Twitter.	87%
Restaurant Recommendation	(Asani et al., 2021)	semantic approach	TripAdvisor	92.8%
E-Commerce Recommendation	(Madhurika et al.2024)	HAEC approach	Amazon Review Dataset	98.54%
Product Recommender system	Katarya & Arora, (2020)	Caps MF	AIV (Amazon Instant Video)Dataset	88%
Attention-Based Recommendation	Vaswani et al. (2021)	Transformer-based Model	Yelp Dataset	83%
Hybrid Recommendation System	Dacrema et al. (2019)	Hybrid Model (CF + Content-based)	Last.fm, MyAnimeList	85%
Explainable Recommendations	Singh et al. (2022)	Explainable Matrix Factorization	Movielens 1M	76%
Sequential Recommendation System	Hidasi et al. (2020)	GRU4Rec (Gated Recurrent Unit)	Yoochoose Dataset	87%
Image-based Product Recommendation	Vasudevan et al. (2020)	CNN (Convolutional Neural Network)	Fashion MNIST	85.6%
Next-Item Recommendation	Zhang et al. (2021)	GRU4Rec (Gated Recurrent Unit)	Amazon Product Data	82.4%
Session-Based Recommendation	Ludovico Boratto et al. (2021)	GRU4Rec	RecSys Challenge 2015 Dataset	68.3%

Cross-Domain Recommendation	Yi Tay et al. (2021)	Deep Cross Network (DCN)	AliExpress Dataset	83.5%
Personalized Recommendations	Huang et al. (2021)	BERT4Rec (BERT model adaptation)	Amazon Beauty, Amazon Books	83%
Social Media Recommendation	(Zhou et al.,2020)	GNN (Graph Neural Networks)	Twitter Dataset	84.50%

2.4. Deep Learning Models in Recommendation Systems

The authors of this paper **(J. Li et al., 2022)** proposed an e-commerce recommendation system that relies on GANs to make citation recommendations. Learning a feature representation from heterogeneous bibliographic networks can be successfully achieved with this model.

In the opinion of **Tahir et al. (2021),** information overload is a potential drawback for e-commerce platform consumers. The excessive media and choices that exist on the internet make it mandatory for internet consumers to shift them out during online purchases. To address this issue, recommendation systems are commonly used. Filtering, prioritizing, and provision of relevant information assists in users' locating their desired product through a recommender system. A recommender avoids time-consuming web searches by producing appropriate content that incites transactions on the web and e-commerce user satisfaction on platforms. In this way, a clothing recommendation engine is used on the offered e-commerce site to match user preferences with suggested products. **(Zhang et al., 2020)** introduced a DRL-based news recommendation system, capturing evolving user preferences. **(S. Wu et al., 2019)** presented a session-based recommendation model using RNN to predict user purchases based on click history. **(He & others, 2018)** proposed an adversarial training model enhancing BPR-based systems. **(Guo & others, 2017**) introduced DFM, integrating MLP and FM. (**Suvash Sedhain, 2017)** suggested item-based and user-based AutoRec recommendation.

Li (2022) stated that there was a need to improve cross-border e-commerce intelligent information recommendation through deep learning (DL) and proposed an enhanced topic model for addressing feature extraction in the text of recommendations. This paper introduced a graph search method and graph model-based niche product recommendation algorithm. It has been evidenced through experiments that industry needs have been met effectively by the deep

learning-based cross-border e-commerce intelligent information recommendation system presented by this report.

Latha et al. (2023) explores sentiment analysis and product recommendations in e-commerce using CNNs. Their system utilizes TF-IDF for feature extraction and evaluates performance on Amazon review datasets. Results indicate superior accuracy, precision, and recall. **Thomas and Jeba (2024)** highlight the growing influence of social media and e-commerce, where user opinions shape product evaluation. Their research proposes **(Learning, 2022)** a novel framework combining sentiment analysis with CF, employing an **(Ahmadian Yazdi et al., 2024)** LSTM-based model for sentiment analysis. Findings suggest that integrating CF and sentiment analysis can enhance consumer satisfaction and improve product recommendations in e-commerce platforms.

2.5. Hybrid Recommender Systems

In **(Kaur & Sharma, 2023; Martins et al., 2020)** it was discovered that the collaborative filtering algorithm (Kaur & Sharma, 2023; Martins et al., 2020) is the most frequently employed approach for recommendation systems. The most common challenges encountered are data ambiguity and sparsity. There were numerous obstacles identified. The research found that association rules mining integrated with traditional recommendation systems effectively found user-item relations. Matrix factorization techniques solved the problem of ambiguity and sparsity. **(Nassar et al., 2020)** is used to Collaborative filtering algorithms when used with fuzzy algorithms helped with sparse data and also provided accurate recommendations. Collaboration algorithms can be constructed effectively using the K-NN classifier algorithm. Since hybrid algorithms are dynamic and simple; it has been concluded that they are more recent and effective than traditional algorithms. Many aspects of hybrid algorithms have not yet been explored. The use of hybrid algorithms improved recommendation accuracy, handled large datasets efficiently; and solved scalability problems.

3. A. Description of Topic

In the field of e-commerce, the creation of e-commerce recommendation systems is made possible by utilising a variety of deep learning models. According to the findings of these models, each one possesses a unique set of benefits and drawbacks. The outcomes of nearly all of the models described in this article were comparable. They excelled in the analysis of historical data, the identification of new users, and the resolution of common challenges that arise in recommendation systems. This research analyses and evaluates the current deep learning algorithms and architectures for e-commerce recommendation systems. Its purpose is to provide light on the operation of these technologies, as well as their limitations and the possibility for further development. In particular; the research project entails the development of a deep learning model for recommender systems in the realm of online shopping. Moreover it intends to address issues with scalability; interpretability, and contextualization as well. The purpose of this endeavour is to provide personalized recommendations that are more in line with the tastes and routines of the user.

B. Problem Statement

The research aims to address the gap by investigating and comparing existing deep learning models for e-commerce recommendations, developing a customized model to cater personalized recommendations and creating an ensemble model that integrates these approaches to evaluate and improve the overall performance of recommendation system.

4. Objectives

The objectives that will be followed in this research are as follows:

1. To investigate existing deep learning models and techniques for E-commerce recommendation systems, and compare their applications and effectiveness
2. To Develop a deep learning model tailored for personalized recommendations and evaluate its performance.
3. To Develop an ensemble model for an e-commerce recommendation system and evaluate its performance

5. Methodology

This section outlines and explains the proposed methodology, as shown in Fig. 4.

A. **Data Collection:** Data collection on user product interactions, including user ratings and attributes.

B. **Pre-Processing**: Collect pertinent e-commerce data, encompassing user engagements, product characteristics, transaction records, and contextual details.

C. **Feature Selection**: In This step, focusing is an algorithm to identify most relevant features for recommendation purposes. It plays a crucial role in reducing the dimensionality of data and improving the performance of recommendation systems. By selecting a subset of features that are most relevant to the task, by this method improves accuracy and efficiency. This involves transforming reviews into TF-IDF vectors, numerically encoding customer and product IDs, and one-hot encoding ratings to create comprehensive inputs for the model, enhancing prediction accuracy, as shown in Fig.3.

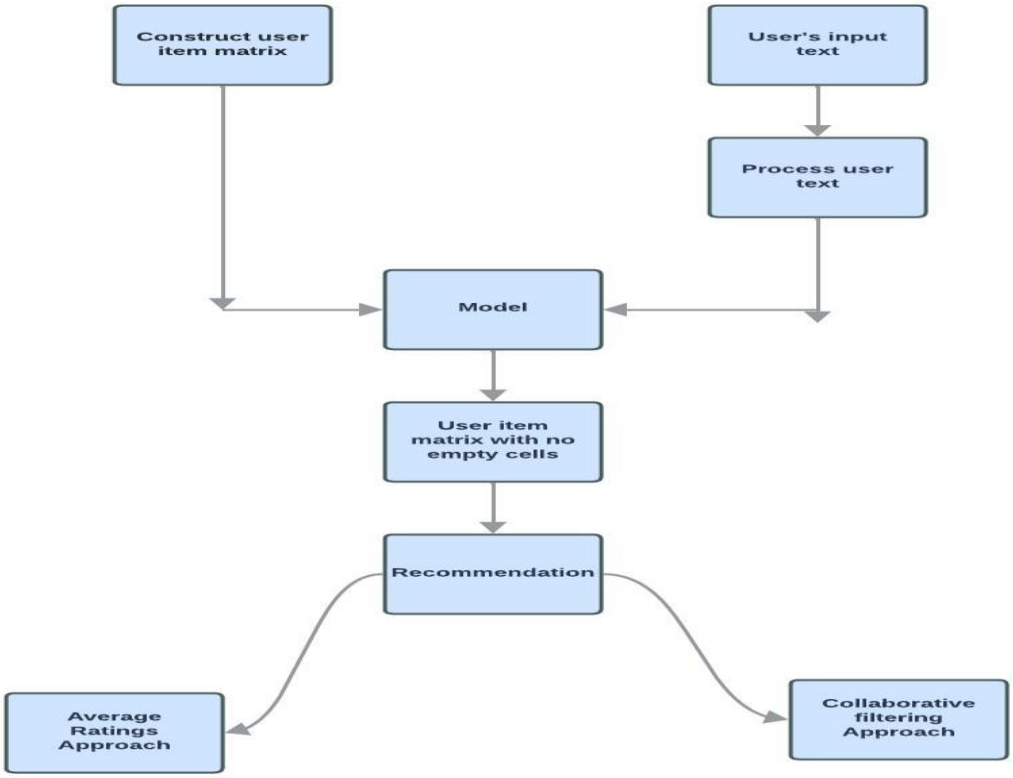

Fig. 3. Feature selection and user recommendation

D. **Method/Model:** The research proposes developing an LSTM-based RNN model for the recommender system and its comparison with the existing models. It also proposes building a hybrid model, such as Hybrid Neural Collaborative Filtering (HNCF), Graph Neural Network based methods and large language models. The aim is to leverage the strengths of each technique to deliver highly accurate and personalized recommendations in e-commerce.

E. **Optimization and Performance:** In this step, focus is on enhancing involves improving the findings after building the models and getting some preliminary data so that they contain fewer errors. Our recommendation models will be trained using e-commerce data we collected and various training techniques such as mini-batch training and gradient descent optimization. An analysis of the models' performance included metrics such as recall, MAP, accuracy, and precision.

F. **Comparison and Analysis:** This research aims to find out whether each strategy is better or worse than another one in terms of how accurate its recommendations are scalability and interpretability. Compare these deep learning-driven recommendation systems' effectiveness to that of standard collaborative filtering techniques, like as well as surface-level machine learning models.

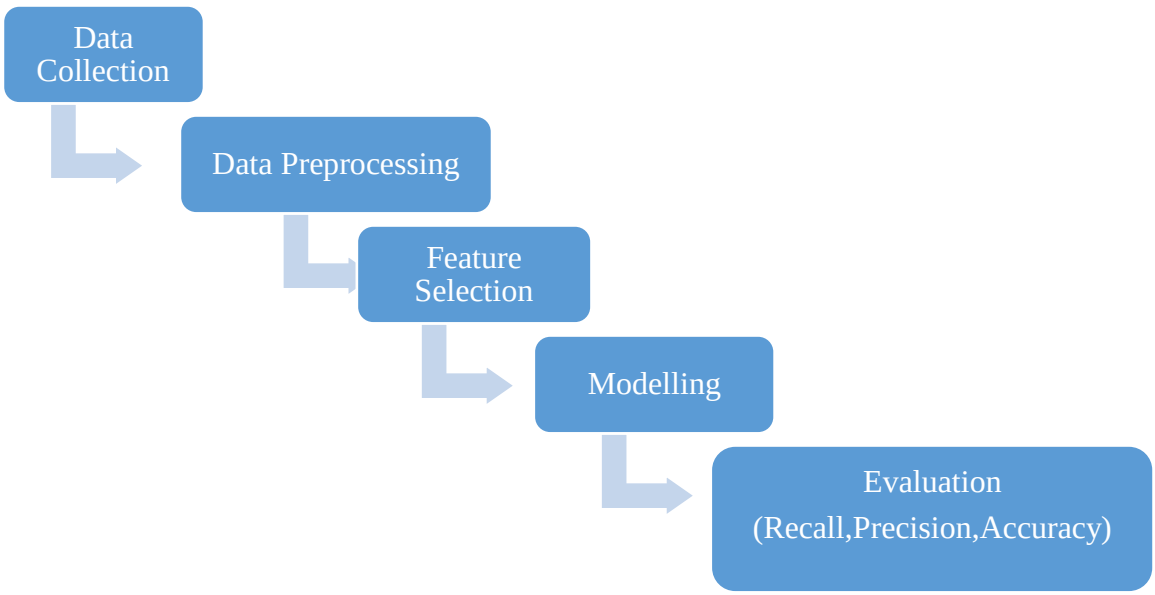

Fig. 4. Proposed Methodology

6. Expected Outcomes

The expected outcomes of this research are as follows:

1. **Improved Recommendation Accuracy:** The developed deep learning-driven recommendation system is expected to outperform traditional methods in terms of recommendation accuracy, providing users with more relevant and personalised product recommendations.
2. **Enhanced User Engagement:** The recommendation system is expected to improve user engagement and satisfaction through the use of deep learning techniques that help in understanding customer preferences and behaviour; this will result to increased conversion rates and repeat purchases.
3. **Scalability and Adaptability:** The new recommendation system should be scalable so as to handle big e-commerce datasets, while also being adaptable to changing user preferences and market trends over time.

Further, this research is also focusses on the following publication specific outcomes:

1. Publication of two conference papers presenting novel findings and methodologies related to the development and evaluation of the deep learning-based hybrid recommendation system.
2. Publication of three peer journal articles detailing comprehensive analyses, comparisons of existing deep learning techniques, and the performance evaluation of the proposed system, as well as future research directions in this rapidly evolving field.

References

1. Ahmadian Yazdi, H., Seyyed Mahdavi, S. J., & Ahmadian Yazdi, H. (2024). Dynamic educational recommender system based on Improved LSTM neural network. Scientific Reports, 14(1), 1–19. https://doi.org/10.1038/s41598-024-54729-y
2. Alamdari, P. M., Navimipour, N. J., Hosseinzadeh, M., Safaei, A. A., & Darwesh, A. (2020). A Systematic Research on the Recommender Systems in the E-Commerce. IEEE Access, 8, 115694–115716. https://doi.org/10.1109/ACCESS.2020.3002803
3. Ha, T., & Lee, S. (2017). Item-network-based collaborative filtering: A personalized recommendation method based on a user's item network. Information Processing and Management, 53(5), 1171–1184. https://doi.org/10.1016/j.ipm.2017.05.003
4. Javed, U., Shaukat, K., Hameed, I. A., Iqbal, F., Alam, T. M., & Luo, S. (2021). A Review of Content-Based and Context-Based Recommendation Systems. International Journal of Emerging Technologies in Learning, 16(3), 274–306. https://doi.org/10.3991/ijet.v16i03.18851
5. Kaur, G., & Sharma, A. (2023). A deep learning-based model using hybrid feature extraction approach for consumer sentiment analysis. Journal of Big Data, 10(1). https://doi.org/10.1186/s40537-022-00680-6
6. Kim, J. K., Choi, I. Y., & Li, Q. (2021). Customer satisfaction of recommender system: Examining accuracy and diversity in several types of recommendation approaches. Sustainability(Switzerland),13(11). https://doi.org/10.3390/su13116165
7. Learning, D. (2022). International Review of Research in Open and Distributed Learning Recommender Systems for MOOCs : A Systematic Literature Recommender Systems for MOOCs : A Systematic Literature Survey.
8. Liao, M., & Sundar, S. S. (2022). When E-Commerce Personalization Systems Show and Tell: Investigating the Relative Persuasive Appeal of Content-Based versus Collaborative Filtering. Journal of Advertising, 51(2), 256–267. https://doi.org/10.1080/00913367.2021.1887013

9. Maphosa, V., & Maphosa, M. (2023). Fifteen Years of Recommender Systems Research in Higher Education: Current Trends and Future Direction. Applied Artificial Intelligence, 37(1). https://doi.org/10.1080/08839514.2023.2175106

10. Martins, G. B., Papa, J. P., & Adeli, H. (2020). Deep learning techniques for recommender systems based on collaborative filtering. Expert Systems, 37(6), 1–21. https://doi.org/10.1111/exsy.12647

11. Mongia, A., Jhamb, N., Chouzenoux, E., & Majumdar, A. (2020). Deep latent factor model for collaborative filtering. Signal Processing, 169. https://doi.org/10.1016/j.sigpro.2019.107366

12. N, M., & Samraj, J. (2023). A hybrid convolutional neural network with long short-term memory (HCNN-LSTM) model based Edge System Recommendation(ESR) for cloud service providers. Measurement: Sensors, 29(June). https://doi.org/10.1016/j.measen.2023.100886

13. Nassar, N., Jafar, A., & Rahhal, Y. (2020). A novel deep multi-criteria collaborative filtering model for recommendation system. Knowledge-Based Systems, 187. https://doi.org/10.1016/j.knosys.2019.06.019

14. Patro, S. G. K., Mishra, B. K., Panda, S. K., Kumar, R., Long, H. V., & Taniar, D. (2023). Cold start aware hybrid recommender system approach for E-commerce users. Soft Computing, 27(4), 2071–2091. https://doi.org/10.1007/s00500-022-07378-0

15. Roy, D., & Dutta, M. (2022). A systematic review and research perspective on recommender systems. Journal of Big Data, 9(1). https://doi.org/10.1186/s40537-022-00592-5

16. Sethi, V., Kumar, R., & Mehla, S. (2024). CAAM- CNN With Autoencoder Attention Mechanism for Recommendation System to Improve Trust in E-commerce Industry. Proceedings of ICWITE 2024: IEEE International Conference for Women in Innovation, Technology and Entrepreneurship, Icwite, 680–685. https://doi.org/10.1109/ICWITE59797.2024.10502883

17. Wang, H., Amagata, D., Makeawa, T., Hara, T., Hao, N., Yonekawa, K., & Kurokawa, M. (2020). A DNN-based cross-domain recommender system for alleviating cold-start problem in e-commerce. IEEE Open Journal of the Industrial Electronics Society, 1(1), 194–206. https://doi.org/10.1109/OJIES.2020.3012627

18. B. Maleki Shoja and N. Tabrizi, "Customer Reviews Analysis with Deep Neural Networks for E-Commerce Recommender Systems," in IEEE Access, vol. 7, pp. 119121-119130, 2019

19. Taehyun Ha, Sangwon Lee, “Item-network-based collaborative filtering: A personalized recommendation method based on a user's item network”, Information Processing & Management, Volume 53, Issue 5, 2017, Pages 1171-1184

20. Quadrana, M., Cremonesi, P., & Jannach, D. (2018). Sequence-aware recommender systems. ACM computing surveys (CSUR), 51(4), 1-36.

21. Almahmood, R. J. K., & Tekerek, A. (2022). Issues and solutions in deep learning-enabled recommendation systems within the e-commerce field. Applied Sciences, 12(21), 11256.

22. Sheikh, A. S., Guigourès, R., Koriagin, E., Ho, Y. K., Shirvany, R., Vollgraf, R., & Bergmann, U. (2019, September). A deep learning system for predicting size and fit in fashion e-commerce. In Proceedings of the 13th ACM conference on recommender systems (pp. 110-118).

23. Shankar, D., Narumanchi, S., Ananya, H. A., Kompalli, P., & Chaudhury, K. (2017). Deep learning based large scale visual recommendation and search for e-commerce. arXiv preprint arXiv:1703.02344.

24. Hussien, F. T. A., Rahma, A. M. S., & Wahab, H. B. A. (2021, May). Recommendation systems for e-commerce systems an overview. In Journal of Physics: Conference Series (Vol. 1897, No. 1, p. 012024). IOP Publishing.

25. Zhu, F., Wang, Y., Chen, C., Zhou, J., Li, L., & Liu, G. (2021). Cross-domain recommendation: challenges, progress, and prospects. arXiv preprint arXiv:2103.01696.

26. Tahir, M., Enam, R. N., & Mustafa, S. M. N. (2021, November). E-commerce platform based on Machine Learning Recommendation System. In 2021 6th International Multi-Topic ICT Conference (IMTIC) (pp. 1-4). IEEE.

27. Shanthi, R., & Rajagopalan, S. P. (2018). A Personalized Hybrid Recommendation Procedure for Internet Shopping Support. International Journal of Advanced Computer Science and Applications, 9(12).

28. Li, Y., Lin, G., Zhou, F., & Su, Z. (2022, October). Session-based Recommendation via Memory Network and Dwell-time Attention. In 2022 9th International Conference on Digital Home (ICDH) (pp. 93-99). IEEE.

29. Thomas, R., & Jeba, J. R. (2024). A novel framework for an intelligent deep learning based product recommendation system using sentiment analysis (SA). Automatika, 65(2), 410-424.

30. Li, J., Li, B., Jiang, Y., & Cai, W. (2022). MSAt-GAN: a generative adversarial network based on multi-scale and deep attention mechanism for infrared and visible light image fusion. Complex & Intelligent Systems. https://doi.org/10.1007/s40747-022-00722-9

31. Zhang, S., Yao, L., Sun, A., & Tay, Y. (2020). Deep Learning Based Recommender System. ACM Computing Surveys, 52(1), 1–38. https://doi.org/10.1145/3285029

32. Guo, H., TANG, R., Ye, Y., Li, Z., & He, X. (2017). DeepFM: A Factorization-Machine based Neural Network for CTR Prediction. Proceedings of the Twenty-Sixth International Joint Conference on Artificial Intelligence, 1725–1731.

33. T. Zhou, L. Chen, Z. Liu and L. Qin, "Content-Based Recommender System for Social Media Recommendation," IEEE Transactions on Knowledge and Data Engineering, vol. 33, p. 1–19, 2020.

34. Liu, X., Yang, Z., & Cheng, J. (2024). Music recommendation algorithms based on knowledge graph and multi-task feature learning. Scientific Reports, 14(1). https://doi.org/10.1038/s41598-024-52463-z

35. Yadav, V., Verma, P., & Katiyar, V. (2023). Long short term memory (LSTM) model for sentiment analysis in social data for e-commerce products reviews in Hindi languages. International Journal of Information Technology (Singapore), 15(2), 759–772. https://doi.org/10.1007/s41870-022-01010-y

36. Asani, E., Vahdat-Nejad, H., & Sadri, J. (2021). Restaurant recommender system based on sentiment analysis. Machine Learning with Applications, 6, 100114. https://doi.org/10.1016/j.mlwa.2021.100114

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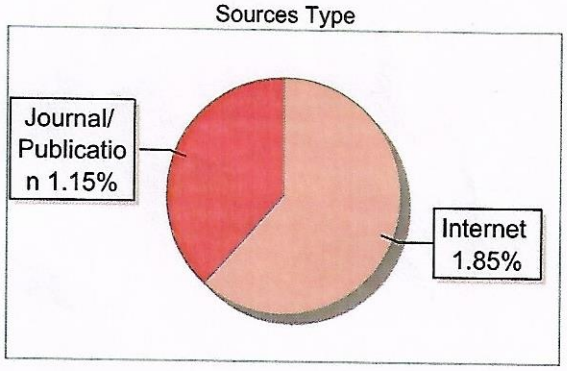

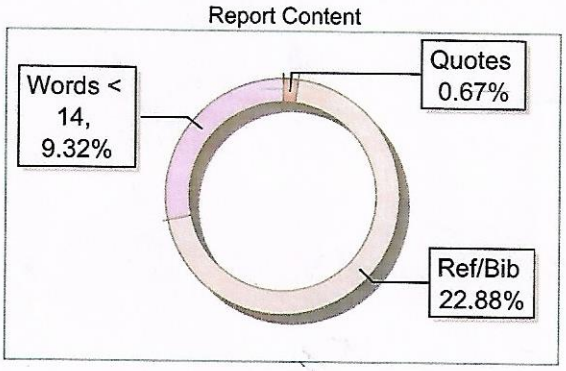

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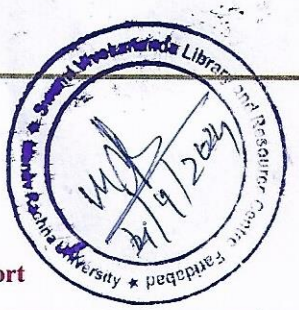

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DEEP LEARNING TECHNIQUES FOR RECOMMENDATION SYSTEM IN E-COMMERCE MARKET

SHORT SYNOPSIS

by

Geetanjali Tyagi

Registration No: MRUCSDN012K200473

Under the supervision of

Prof. (Dr.) Goldie Gabrani
Dr. Atul Mishra

2024

Abstract

The importance of E-commerce has grown significantly due to the wide expansion of global markets and finance. System analysis and design methodologies are required to construct a fully functional, scalable, efficient, reliable, user-friendly, and secure E-commerce recommendation system. With the rapid growth of internet technologies, most firms have changed their ways of doing things entirely. As e-commerce platforms have emerged, users now can shop virtually from anywhere around the globe without leaving their homes. We need recommendation systems to enhance the User Experience (UX) in E-commerce. These systems help users find relevant products quickly and efficiently. This research proposes a Deep Learning (DL) based hybrid recommendation system. This proposed system aims to help users identify the most suitable products according to their needs while minimizing search time and effort. Additionally, the research compares existing deep learning approaches in e-commerce

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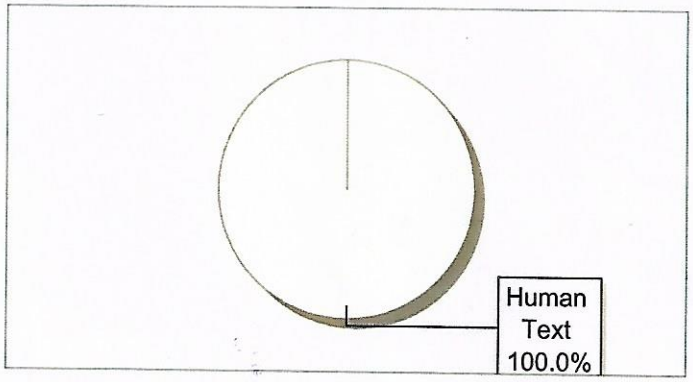

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